CLAIMS

I claim:

1. An apparatus for monitoring a biological process comprising a processor performing the steps of:

receiving image data relating to the biological process, said image data corresponding to frames comprising a plurality of pixels;

dividing each frame into a plurality of regions and each region into a plurality of subregions;

filtering pixels in each subregion according to a pixel intensity range to provide a filtered output of pixels;

comparing the filtered output of pixels in a first area of each subregion to a second area of each subregion to produce a signal for each subregion;

transforming each signal according to each signal's current level to produce a transformed output signal for each subregion; and

analyzing the transformed output signals for the plurality of subregions to monitor the biological process.

2. The apparatus of claim 1 wherein the biological process is microscopic.

3. The apparatus of claim 1 wherein the biological process is macroscopic.

4. The apparatus of claim 3 wherein the macroscopic biological process is drowsiness.

5. The apparatus of claim 4 wherein the step of receiving image data includes receiving data of facial images of an operator.

6. The apparatus of claim 5 wherein the plurality of regions comprise an eye region, a mouth region and a facial boundary region.

7. The apparatus of claim 1 further comprising a video unit for acquiring said image data.

8. The apparatus of claim 1 wherein the step of filtering comprises:

determining whether a video intensity level of each pixel is within the pixel intensity range; and

setting the video intensity level to a predetermined value if the video intensity level is within the range and to another predetermined value if the video intensity level is outside the range to provide the filtered output.

9. The apparatus of claim 1 wherein the step of comparing comprises:

configuring the shape of the first area and the shape of the second area for each subregion;

evaluating the amount of the filtered output of pixels in the first area and in the second area;

determining the difference between the filtered output of pixels in the first area and the second area; and

producing the signal based on the step of determining.

10. The apparatus of claim 1 wherein the step of transforming comprises:

setting the signal for each subregion at a first time as a transformed output signal for each subregion;

evaluating whether the level of the signal at a second time is different than the level of the transformed output signal at the first time; and

setting a transformed output signal for the second time in accordance with the step of evaluating.

11. The apparatus of claim 10 wherein the second step of setting comprises optimizing the transformed output signal for the first time pursuant to an algorithm when the level of the signal at the second time is different than the level of the transformed output signal at the first time and setting the level of the signal at the second time to the optimized level of the signal for the first time.

12. The apparatus of claim 1 wherein the step of analyzing comprises:

combining the transformed output signals pursuant to an algorithm to produce a composite measure of the biological process; and

determining whether the composite measure is below a threshold.

13. The apparatus of claim 12 further comprising sounding an alarm when the composite measure is below the threshold.

14. The apparatus of claim 12 further comprising generating electrical control signals pursuant to an algorithm when the composite measure is below the threshold.

15. A method for monitoring a biological process comprising the steps of:

receiving image data relating to the biological process, said image data corresponding to frames comprising a plurality of pixels;

dividing each frame into a plurality of regions and each region into a plurality of subregions;

filtering pixels in each subregion according to a pixel intensity range to provide a filtered output of pixels;

comparing the filtered output of pixels in a first area of each subregion to a second area of each subregion to produce a signal for each subregion;

transforming each signal according to each signal's current level to produce a transformed output signal for each subregion;

analyzing the transformed output signals for the plurality of subregions to monitor the biological process; and

generating electrical control signals from the transformed output signals pursuant to an algorithm to control the biological process.

16. The method of claim 15 wherein the step of receiving image data includes receiving data of facial images of an operator.

17. The method of claim 15 wherein the step of filtering comprises:

determining whether a video intensity level of each pixel is within the pixel intensity range; and

setting the video intensity level to a predetermined value if the video intensity level is within the range and to another predetermined value if the video intensity level is outside the range to provide the filtered output.

18. The method of claim 15 wherein the step of comparing comprises:

configuring the shape of the first area and the shape of the second area for each subregion;

evaluating the amount of the filtered output of pixels in the first area and in the second area;

determining the difference between the filtered output of pixels in the first area and the second area; and

producing the signal based on the step of determining.

19. The method of claim 15 wherein the step of transforming comprises:

setting the signal for each subregion at a first time as a transformed output signal for each subregion;

evaluating whether the level of the signal at a second time is different than the level of the transformed output signal at the first time; and

setting a transformed output signal for the second time in accordance with the step of evaluating.

20. The method of claim 19 wherein the second step of setting comprises optimizing the transformed output signal for the first time pursuant to an algorithm when the level of the signal at the second time is different than the level of the transformed output signal at the first time and setting the level of the signal at the second time to the optimized level of the signal for the first time.

21. The method of claim 14 wherein the step of analyzing comprises:

combining the transformed output signals pursuant to an algorithm to produce a composite measure of the biological process; and

determining whether the composite measure is below a threshold.

22. The method of claim 21 further comprising sounding an alarm when the composite measure is below the threshold.